CLAIMS

Having described the preferred embodiments, the invention is now claimed to be:

1. A radio frequency coil **(44, 44', 44", 144, 154)** comprising:

a substrate **(72)**;

a radio frequency antenna **(90)** disposed on the substrate **(72)**; and

an electronics module **(78, 78')** disposed on the substrate **(72)** and electrically connected with the radio frequency antenna **(90)**.

2. The radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **1**, wherein:

the electronics module **(78, 78')** is disposed on a central region **(96)** of the substrate **(72)**; and

the radio frequency antenna **(90)** includes a conductor disposed on the substrate **(72)** outside of and at least partially surrounding the central region **(96)** of the substrate **(72)**.

3. The radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **2**, wherein the conductor of the radio frequency antenna **(90)** comprises:

a conductive film disposed on the substrate **(72)** defining at least one conductive loop **(90)** substantially surrounding the central region of the substrate **(72)**, ends **(100)** of said at least one conductive loop **(90)** extending into the central region **(96)** of the substrate **(72)** and connecting with the electronics module **(78, 78')**.

4. The radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **3**, wherein the substrate **(72)** comprises:

a flexible electrically insulating material.

5. The radio frequency coil **(44', 144, 154)** as set forth in claim **3**, wherein the electronic module **(78')** comprises:

printed circuitry **(110)** disposed on the substrate **(72)**; and

one or more discrete circuit components **(112, 114, 116)** electrically connected via the printed circuitry **(110)**.

6. The radio frequency coil **(44", 144, 154)** as set forth in claim **2,** further comprising:

at least one spacer element **(130)** disposed between the substrate **(72)** and the electronics module **(78)**, the at least one spacer element **(130)** defining a spacing (D_{spc}) between the electronics module **(78)** and the radio frequency antenna **(90)**.

7. The radio frequency coil **(44", 144, 154)** as set forth in claim **6,** wherein the spacing (D_{spc}) is at least about one-fifth of a lateral dimension (W_{ant}) of radio frequency antenna **(90)**.

8. The radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **2,** wherein the electronics module **(78, 78')** has a lateral dimension (W_{elec}) that is less than or about three-fifths of a lateral dimension (W_{coil}) of the radio frequency antenna **(90)**.

9. The radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **1,** wherein the electronic module **(78, 78')** comprises:

a wireless transmitter **(116, 126)** transmitting a transmission signal representative of a radio frequency signal received by the radio frequency antenna **(90)**.

10. The radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **1,** wherein the electronic module **(78, 78')** comprises:

a one or more noisy circuit components **(114)** generating substantial radio frequency interference;

one or more quiet circuit components **(112, 116)** not generating substantial radio frequency interference; and

a radio frequency shield **(120)** disposed around the one or more noisy circuit components **(114)** but not around the one or more quiet circuit components **(112, 116)**.

11. The radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **10,** wherein:

the radio frequency antenna **(90)** defines a loop surrounding a central region **(96)** of the substrate **(72)**; and

the radio frequency shield **(120)** is disposed substantially centered in the central region **(96)** of the substrate **(72)**.

12. The radio frequency coil **(44, 44', 44'', 144, 154)** as set forth in claim **1**, wherein the electronic module **(78, 78')** does not include a ground plane.

13. The radio frequency coil **(44, 44', 44'', 144, 154)** as set forth in claim **1**, wherein inductors **(112)** of the electronic module **(78, 78')** are selected from a group consisting of:

toroidal inductors **(112)**, and
solenoidal inductors with balanced turns.

14. A radio frequency coils array **(40, 140, 150)** comprising:

a plurality of radio frequency coils **(44, 44', 44'', 144, 154)** as set forth in claim **2** arranged such that the radio frequency antennae **(90)** of the plurality of radio frequency coils **(44, 44', 44'', 144, 154)** span a coil array surface.

15. The radio frequency coils array **(40)** as set forth in claim **14**, wherein the substrates **(72)** of at least some of the plurality of radio frequency coils **(44, 44', 44'')** are tilted with respect to the substrates **(72)** of other coils of the plurality of radio frequency coils **(44, 44', 44'')** such that the coil array surface is non-planar.

16. The radio frequency coils array **(40, 150)** as set forth in claim **14**, wherein at least one coil of the plurality of radio frequency coils **(44, 44', 44'', 154)** is entirely surrounded by other coils of the plurality of radio frequency coils **(44, 44', 44'', 154)**.

17. The radio frequency coils array **(40, 150)** as set forth in claim **14**, wherein the plurality of radio frequency coils **(44, 44', 44'', 154)** are arranged in an N×M array where N>2 and M>2.

18. The radio frequency coils array **(40, 150)** as set forth in claim **14**, wherein at least some of the coils of the plurality of radio frequency coils **(44, 44', 44'', 154)** share a common substrate.

19. A magnetic resonance imaging system comprising:

a main magnet **(20)** producing a substantially temporally constant main magnetic field within a field of view;

magnetic field gradient coils **(30)** that impose selected magnetic field gradients on the main magnetic field within the field of view;

a means **(32, 54)** for applying a radio frequency pulse to the field of view; and

at least one radio frequency coil **(44, 44', 44", 144, 154)** as set forth in claim **1** arranged to detect a magnetic resonance signal induced by the applied radio frequency pulse.

20. A magnetic resonance imaging method comprising:

exciting magnetic resonance in an imaging subject **(16)**; and

receiving a magnetic resonance signal using one or more radio frequency coils **(44, 44', 44", 144, 154)** as set forth in claim **1** with the radio frequency antenna **(90)** of each coil in proximity to the imaging subject **(16)**.